CONFIRMATION

I, KIM, Chang Young, having the address at "19th Fl. Keungil Tower, 677-25, Yeoksam-dong, Gangnam-gu, Seoul 135-914, Korea" herewith confirm that I am well acquainted with the Korean and English language and that to the best of my knowledge and belief the attached document is a true and complete English translation of the priority document of Korean Patent Application No. 10-2003-0033989.

at AIP Patent & Law Offices on February 16, 2009

C. Y Kim

KIM, Chang Young

Place, Date, Signature

(English translation of the priority document)

KOREAN INTELLECTUAL PROPERTY OFFICE

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Applicant(s) : Seoul Semiconductor Co., Ltd.

COMMISSIONER /seal/

[Abstract]

A package structure for a light emitting device and a light emitting device using the same of the invention enable heat generated in the device to be dissipated by configuring heat sinks insulated and separated from each other in at least two parts and directly mounting a plurality of semiconductor light emitting diodes onto the respective heat sinks, without using a sub-mount and forming pad electrodes on the sub-mount when mounting the plurality of semiconductor light emitting diodes.

[Representative Drawing]

Fig. 1

[Index]

Semiconductor light emitting device, LED, LD, package structure, high power

[Specification]

[Title of the Invention]

Package for high-power semiconductor light emitting devices and semiconductor light emitting device using the same

[Brief Description of the Drawings]

Fig. 1 and Fig. 2 are a perspective view and a plan view illustrating the LED package structure according to an embodiment of the invention, respectively.

Fig. 3 is a cross sectional view taken along the line A-A of Fig. 2.

Fig. 4 is a perspective view illustrating the state where LED dies are mounted on the package structure of Fig. 1.

[Description of the Invention]

[Purpose of the Invention]

[Technical Field and Backgroun Art of the Invention]

The present invention relates to a package structure for light emitting devices and a light emitting device using the same, and more particularly, to a package structure for high power light emitting devices and a light emitting device using the same.

In order to use a light emitting diode (LED) for illumination purpose, there is a need to integrate a number of LED chips in one package. Corresponding to such a need, high cost LEDs such as flip-chip LEDs are used conventionally. Otherwise, in case of using general LEDs, pad electrodes are formed on a sub-mount after the sub-mount is formed on a heat sink, and the LEDs are mounted on the pad electrodes.

For example, a method of manufacturing a high power LED package with forming a sub-mount is described in KR Patent Publication No. 1999-0078736. In such a conventional technique, a number of processes, such as formation of metal patterns on a sub-mount and attachment of the sub-mount on a heat sink, must be added, resulting in increase of the number of mounting equipments and device fabrication time.

[Technical Purpose of the Invention]

Therefore, an object of the present invention is to provide a semiconductor light emitting device in which a number of semiconductor light emitting diodes can be disposed in one package by using heat sinks electrically insulated and separated from each other, without forming a sub-mount and pad electrodes on the sub-mount.

It is another object of this invention to provide a package structure suitable for decreasing heat generated from light emitting diodes and thus obtaining high power by directly mounting a number of semiconductor light emitting diodes on heat sinks separated in at least two parts, and to provide a semiconductor light emitting device using the same.

It is a further object of this invention to provide a package structure for a high power semiconductor light emitting device and a semiconductor light emitting device using the same, wherein fabrication processes thereof are simple and fabrication cost thereof can be reduced.

[Summary of the Invention]

In order to achieve the above objects and other objects, a package structure for a light emitting device according to the present invention comprises;

heat sinks separated from each other in at least two parts, the heat sinks

being used to directly mount a plurality of semiconductor light emitting diodes thereon and to dissipate heat generated from the light emitting diodes, and the heat sinks being used in electrical connections of the semiconductor light emitting diodes;

a pair of lead terminals being used to electrically connect mounted semiconductor light emitting diodes to outer power source; and

a main body supporting the heat sinks and the lead terminals and electrically insulating the respective separated heat sinks from each other.

A semiconductor light emitting device according to another aspect of the present invention comprises:

a plurality of semiconductor light emitting diodes;

heat sinks separated from each other in at least two parts, the heat sinks being used to directly mount semiconductor light emitting diodes thereon and to dissipate heat generated from the light emitting diodes, and the heat sinks being used in electrical connections of the semiconductor light emitting diodes;

a pair of lead terminals electrically connected to the semiconductor light emitting diodes;

a main body supporting the heat sinks and the lead terminals and electrically insulating the respective separated heat sinks from each other; and

a lens formed on the main body to enclose the semiconductor light emitting diodes.

The lens may be formed by injecting transparent epoxy or silicone, and a diffuser or a fluorescent material may be included therein.

Hereinafter, embodiments according to the present invention are described referring to the accompanying drawings.

At first, referring to Figs. 1 to 3, a package structure for semiconductor light emitting device according to the present invention comprises heat sinks 300, on which a number of LEDs (not shown) are mounted, a pair of lead

terminals 210 and 220 used in electrical connections of an LED, and a main body 100 supporting the heat sinks 300 and the lead terminals 210 and 220.

The heat sinks 300 are used to dissipate heat generated when using a number of high power LEDs and also used in electrical connections of the LEDs, and the heat sinks 300 is divided into a first heat sink 310 and a second heat sink 320. In this embodiment, an example where the heat sinks 300 are divided into two parts is described for a convenience of description, but the heat sinks can be divided into two or more parts according to a desired design. Further, in order to effectively collimate light emitted from the LEDs, the heat sinks 300 may be formed concavely to form a reflector at their outer periphery. A material with high heat conductivity, such as copper, gold, silver, silicon carbide, Ain etc., is preferable for a material of the heat sinks 300.

The main body may be formed by injection molding a plastic resin, and PC, PCABS, PPA, nylon, PET, PBT, amodel and so on can be used as a material of the main body. When forming the main body by the injection molding, the main body may be formed in a single body along with a septum 110 that electrically isolates the heat sinks 310 and 320 from each other.

A pair of the lead terminals 210 and 220 is used in electrical connection of the LEDs, and they have a curved shape suitable to be mounted on a printed circuit board (PCB) or others. Although there are shown only a pair of lead terminals in these figures, a lead terminal thermally connected to the heat sinks 300 to promote thermal relief, or a lead terminal for supporting the package safely when the package is mounted on a PCB or others may be further formed.

Now, referring to Fig. 4, a semiconductor light emitting device having a number of LEDs mounted on the package structure of Figs. 1 to 3 is described. For a convenience of description, there are illustrated only 6 LEDs in Fig. 4, wherein 3 LEDs are mounted on each of the first heat sink 310 and the second heat sink 320. However, the number of the LEDs mounted in the package may

be varied with a desired purpose. Further, wavelength ranges or types of the LEDs may be variously selected with a desired purpose.

The 3 LED chips 500 are attached on the first and second heat sinks 310 and 320, respectively, and they are connected through wires 510. In this case, the wires are connected such that the 3 LED chips attached on the first heat sinks 310 are connected in parallel, the 3 LED chips attached on the second heat sinks 320 are also connected in parallel, and the LED chips on the first heat sink 310 and the LED chips on the second heat sink 320 are connected in series. According to the present invention, it is possible to make a series/parallel circuit by properly connecting the wires after the chips are mounted on the first and second heat sinks that are electrically insulated from each other, and thus it is possible to decrease heat generation even in case of using high power LEDs. In addition, wiring connection advantageously becomes simple.

In order to protect the LED chips and obtain a light collimation effect, a lens 400 is formed with transparent epoxy or silicone on the main body to enclose the LED chips. A diffusing material may be added into the lens so that shapes of the LED chips, wires and others do not appear on the outside, and a fluorescent material may be added to convert a wavelength of light. For example, the fluorescent material may be a material including at least one element selected from the group consisting of Ca, Sr, Ba and O, and at least one element selected from the group consisting of Al, O and Si, and activated by Eu. The shape of the lens 400 may be a concave or convex shape.

[Effect of the Invention]

For the package structure for a semiconductor light emitting device and the light emitting device according to the present invention, a number of light emitting diodes can be disposed in one package by using heat sinks electrically insulated and separated from each other, without forming a sub-mount and

electrodes on the sub-mount, and thus fabrication processes thereof become simple and fabrication cost thereof can be reduced.

In addition, for the package structure for a semiconductor light emitting device and the light emitting device according to the present invention, the wiring connection becomes simple since a number of light emitting diodes are directly mounted on the heat sinks separated into at least two parts. With a proper wiring connection, driving current can be reduced, and thus heat generated from a light emitting diode can be decreased. Therefore, a package for a high power semiconductor light emitting device suitable for illumination use can be provided.

Further, since the main body can be formed by injection molding in the present invention, the parts of the heat sinks can be simply electrically separated from each other, and thus the fabrication processes become simpler.

In the meantime, though a package structure and a device where a number of LEDs are mounted in one package are described above, the present invention is not limited thereto, and the invention can be applied to the case where a number of laser diodes (LD) are mounted in one package.

Though technical features of the present invention have been described above based on particular embodiments, it is apparent that those who have an ordinary skill in the art of the present invention can modify or change the present invention even within the technical scope of the present invention.

Claims

1. A package structure for a high power semiconductor light emitting device, the package structure being for mounting a plurality of semiconductor light emitting diodes, the package structure comprising:

heat sinks separated from each other in at least two parts, the heat sinks being used to directly mount semiconductor light emitting diodes thereon and to dissipate heat generated from the light emitting diodes, and the heat sinks being used in electrical connections of the semiconductor light emitting diodes;

a pair of lead terminals being used to electrically connect mounted semiconductor light emitting diodes to outer power source; and

a main body supporting the heat sinks and the lead terminals and electrically insulating the respective separated heat sinks from each other.

2. The package structure of claim 1, wherein the surfaces of the heat sinks on which the semiconductor light emitting diodes are mounted are formed in a concave shape to increase light extraction efficiency.

3. The package structure of claim 1, further comprising:

a lead terminal suitable for setting the package structure or dissipating heat.

4. The package structure of claim 1, wherein the main body is formed by injection molding.

5. A high power light emitting device, comprising:

a plurality of semiconductor light emitting diodes;

heat sinks separated from each other in at least two parts, the heat sinks being used to directly mount semiconductor light emitting diodes thereon and to dissipate heat generated from the light emitting diodes, and the heat sinks being used in electrical connections of the semiconductor light emitting diodes;

a pair of lead terminals electrically connected to the semiconductor light

emitting diodes;

a main body supporting the heat sinks and the lead terminals and electrically insulating the respective separated heat sinks from each other; and

a lens formed on the main body to enclose the semiconductor light emitting diodes.

6. The high power light emitting device of claim 5, further comprising:

a lead terminal suitable for setting the high power light emitting device or dissipating heat.

7. The high power light emitting device of claim 5, wherein the lens is formed by injecting transparent epoxy or silicone.

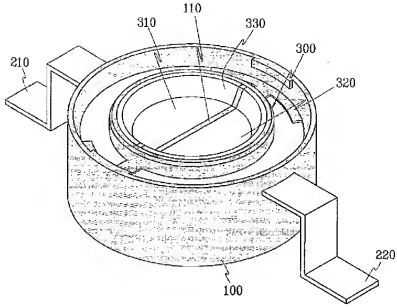
8. The high power light emitting device of claim 7, wherein a diffuser or a fluorescent material is incorporated in the epoxy or silicone.

9. The high power light emitting device of claim 8, wherein the fluorescent material is a material including at least one element selected from the group consisting of Ca, Sr, Ba and O, and at least one element selected from the group consisting of Al, O and Si, and activated by Eu.

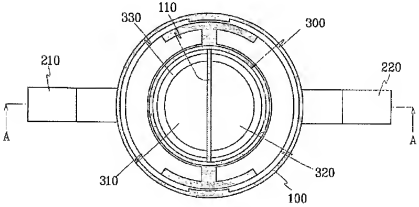
10. The high power light emitting device of claim 5, wherein the main body is formed by injection molding.

[Drawings]

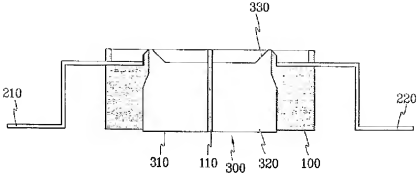
【Fig. 1】



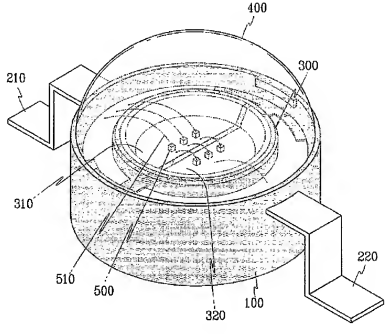
【Fig. 2】



【Fig. 3】


330
210
220
310
110
300
320
100

【Fig. 4】


400
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510
500
320
100